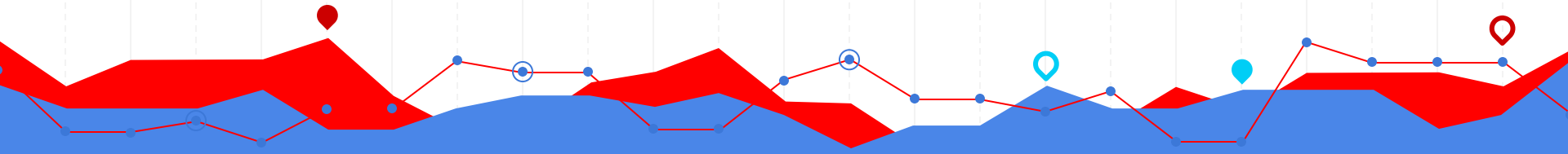


Using NASA Data to Enhance Earth Science Education & Make STEM Connections

NSTA 2018, *Science on My Mind*

Elizabeth Joyner, NASA Langley Research Center, Hampton, VA

Please sit in groups by Grade Band: 3-5, 6-8, 9-12

Survey

https://b.socrative.com/login/student/

Room ID:

MYNASADATA

About Me...

Elizabeth Joyner

Langley Research Center

VIRGINIA SPACE GRANT CONSORTIUM

South Carolina Space Grant Consortium

COSEE CENTERS FOR OCEAN SCIENCES EDUCATION EXCELLENCE

COLLEGE of CHARLESTON 1770

AGI american geosciences institute connecting earth, science, and people

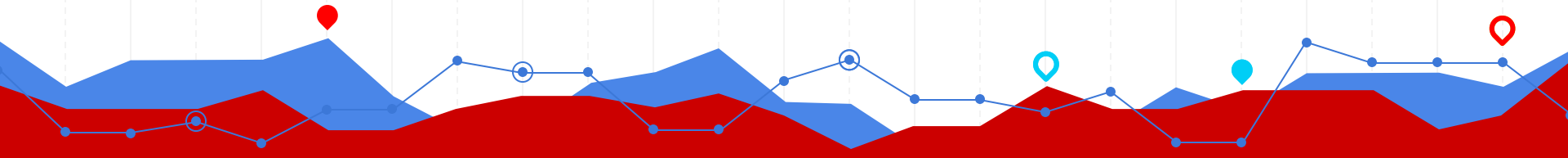
Sea Grant S.C. Sea Grant Consortium

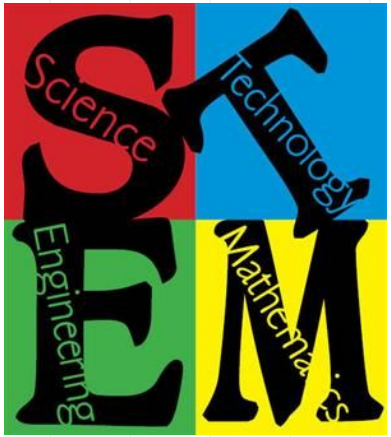
Goals:

1. Current My NASA Data (MND)
2. MND STEM connection
3. Future MND
4. Engage Prior Knowledge
5. Group Activities: 1.) Beginner Data Cubes -or- 2.) Intermediate Data Cubes
6. Reflect
7. 

What is My NASA Data?

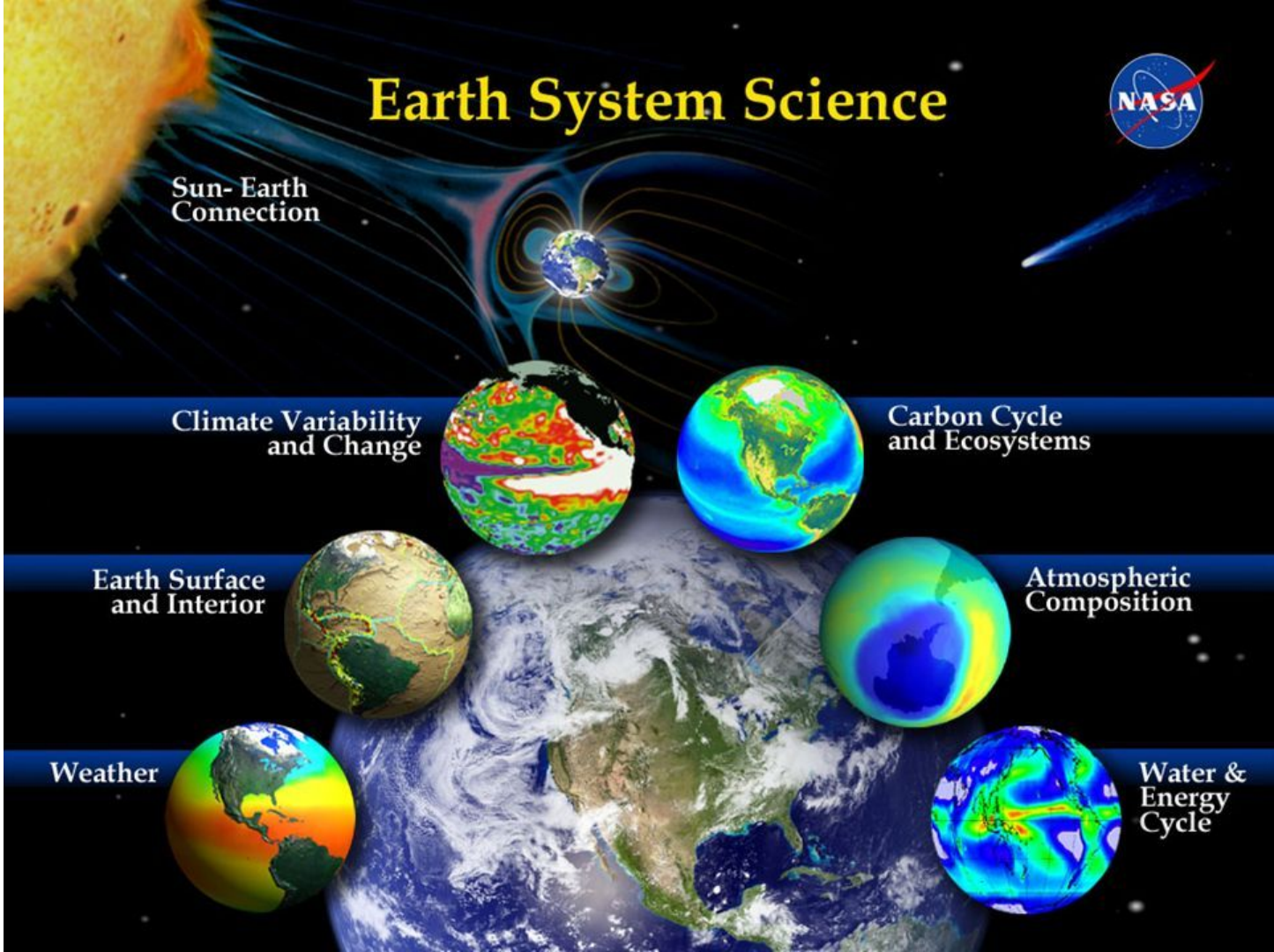
- Started in 2004
- User group- teachers, students, citizen scientists, scientists, & data users
- Offers Earth Science data, organized by sphere in the Earth System
- Data Visualization tool - known as a Live Access Server (LAS)
- Lesson plans illustrate how to use LAS with data sets and graphs





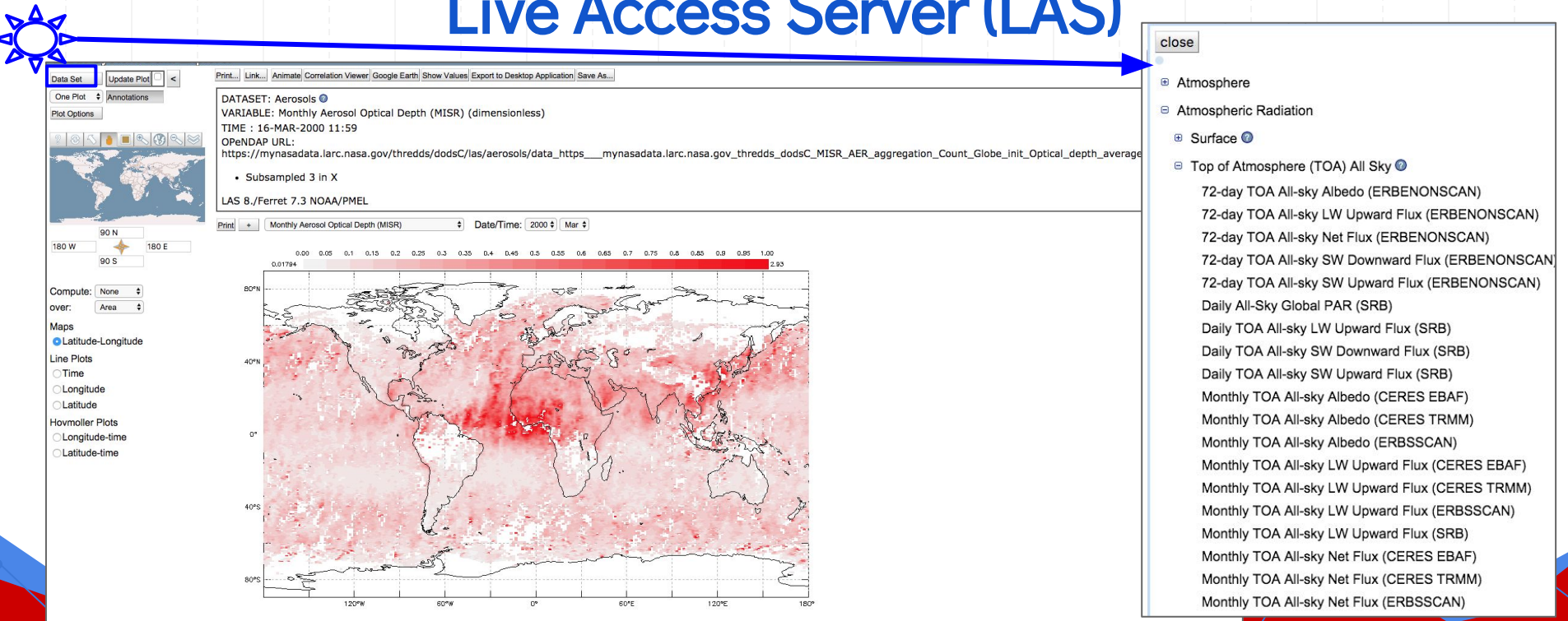
Seeing MND through a STEM Context

"S" in STEM - Earth System Science data



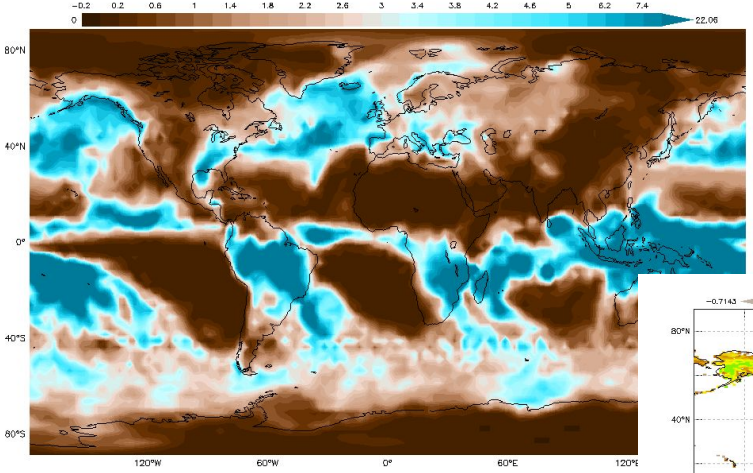
"S" + "T" in STEM - Data Visualization

Current Data Visualization Tool - Live Access Server (LAS)

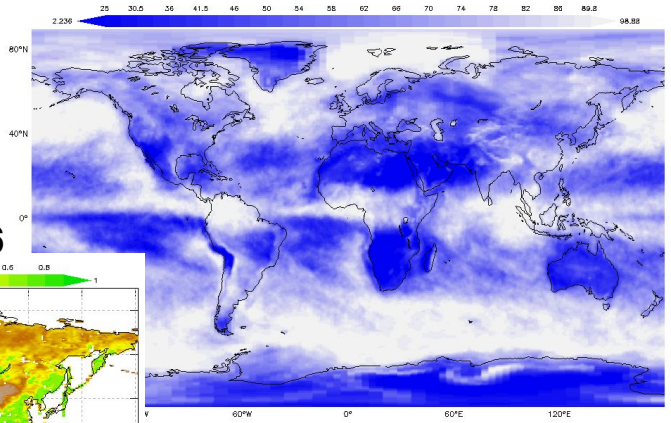


MY NASA DATA

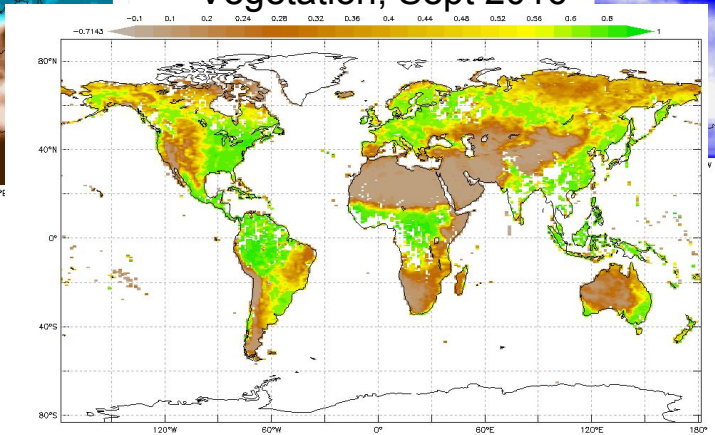
Precipitation, March 2016



Cloud Cover, Sept. 2016



Vegetation, Sept 2016

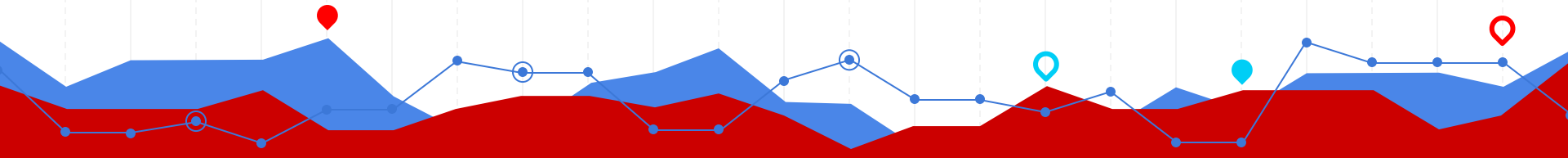


"E" in STEM- Satellite Data

- MND leverages Earth Science data made available through NASA engineering and technology
  - ***Does not offer integrated engineering design challenges***

- <u>Engineering Enables NASA to do Science!</u>

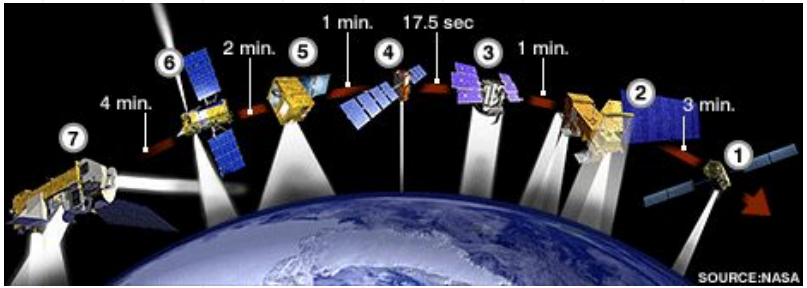
- Pulls data collected on NASA's A-Train, as well as other satellite missions!



"E" in STEM- Satellite Data

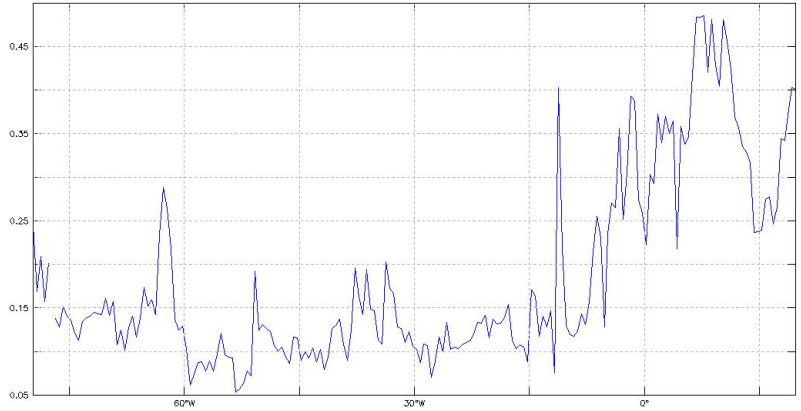
- NASA & International partners
- 6 satellites that fly in a coordinated orbit to collect data on Earth system.
- 15+ scientific instruments
- Satellites on *nearly* same polar orbital "track."
- Cross the equator northbound at about 1:30 p.m. local time, within seconds to minutes of each other.

Afternoon Train

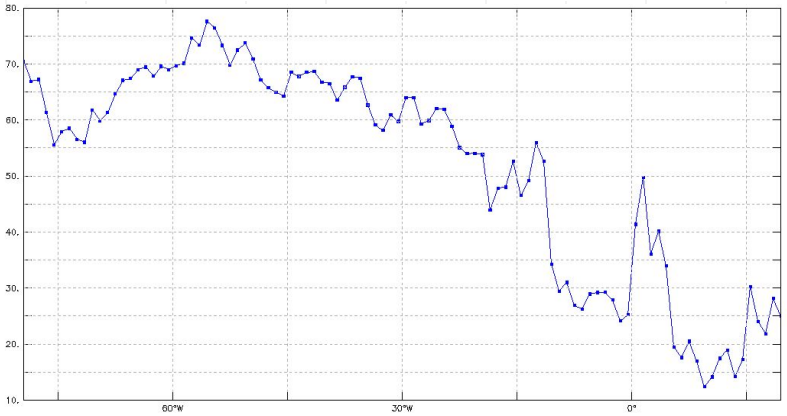


"M" in STEM- Mathematics & Data Literacy

Monthly Aerosol Optical Depth (MISR)
(dimensionless)
LATITUDE : 28.8N, 16-APR-2015 00:00



Monthly Cloud Coverage (CERES) (percent)
LATITUDE : 28.8N, 16-APR-2015 00:00



Evaluation & Insights

common sense education

Digital Citizenship | EdTech Reviews & Resources

Review by Christie Thomas, Common Sense Education | Updated March 2015

MY NASA DATA

NASA satellite data + teacher support yields serious inquiry resource

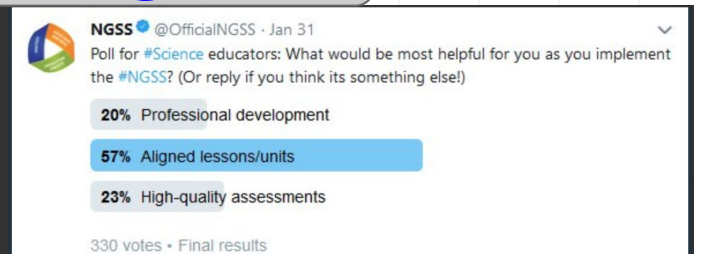
Subjects & skills

Grades 2-12

Visit website

Common Sense says (See details)

Teachers say (0)



Pros: Access real satellite data for free in the classroom.

Cons: Interfacing with the Live Access Server and interpreting its data may feel intimidating, even for many educators.

Bottom Line: The value of the resource outweighs the challenges, so grab your coffee, a colleague, and your thinking cap and dive in.

Formal evaluations from educators underscore these *informal* insights.

Pros: Access real satellite data for free in the classroom.

Cons: Interfacing with the Live Access Server and interpreting its data may feel intimidating, even for many educators.

Bottom Line: The value of the resource outweighs the challenges, so grab your coffee, a colleague, and your thinking cap and dive in.


Time for Change

Identify and Focus on Teachers' Needs

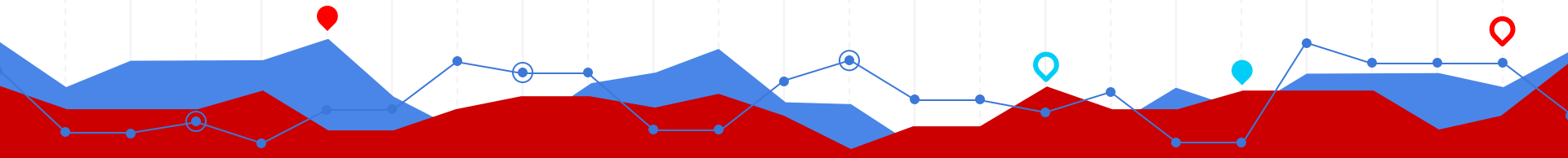
Dedicated to helping teachers of **grades 3-12** teach Earth System phenomenon using NASA Earth System data

- Pulling resources from a variety of NASA visualizations
- Organizing resources by Earth System phenomenon
- Prepackaging Maps & Data = "Just in Time"

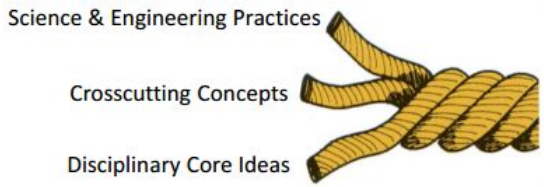
Tell A Story...

Identify what stories need to be told:

- NGSS-inspired tools to:
  - structure of phenomenon
  - systems approach
  - spatial and temporal scales
  - leveraging GLOBE activities and protocols



MND Supports NGSS IN YOUR CLASSROOM



Science and Engineering Practices

1. Asking Questions (for science) and Defining Problems (for engineering)
2. Developing and Using Models
3. Planning and Carrying Out Investigations
4. Analyzing and Interpreting Data
5. Using Mathematics and Computational Thinking
6. Constructing Explanations (for sci) and Designing Solutions (for eng)
7. Engaging in Argument from Evidence
8. Obtaining, Evaluating, and Communicating Information

Disciplinary Core Ideas

PHYSICAL SCIENCES
PS1: Matter and Its Interactions
PS2: Motion and Stability: Forces and Interactions
PS3: Energy
PS4: Waves and Their Applications in Technologies for Information Transfer

LIFE SCIENCES
LS1: From Molecules to Organisms: Structures and Processes
LS2: Ecosystems: Interactions, Energy, and Dynamics
LS3: Heredity: Inheritance and Variation of Traits
LS4: Biological Evolution: Unity and Diversity

EARTH AND SPACE SCIENCES
ESS1: Earth's Place in the Universe
ESS2: Earth's Systems
ESS3: Earth and Human Activity

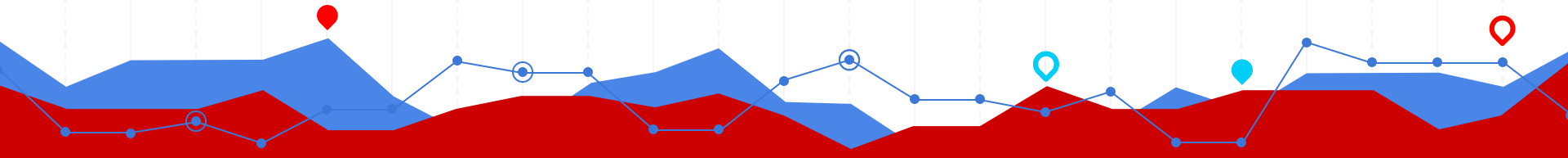
ENGINEERING, TECHNOLOGY, AND APPLICATIONS OF SCIENCE
ETS1: Engineering Design
ETS2: Links Among Engineering, Technology, Science, and Society

Crosscutting Concepts

1. Patterns
2. Cause and Effect: Mechanisms and Explanation
3. Scale, Proportion, and Quantity
4. Systems and System Models
5. Energy and Matter: Flows, Cycles, and Conservation
6. Structure and Function
7. Stability and Change

Core Inquiries Supported by MND

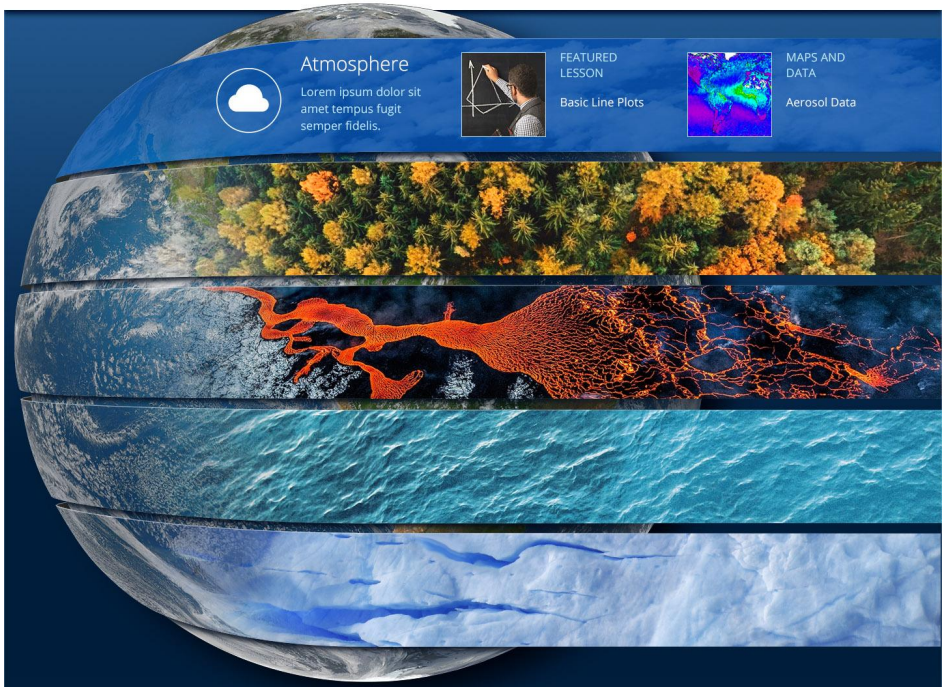
- ★ Exploring an Earth System Variable over Space and Time
- ★ Exploring Relationships between & among Variables



my NASA data

Search

Atmosphere | Biosphere | Geosphere | Hydrosphere | Cryosphere | Earth as a System | Visualize Data | Resources | Overview



What is My NASA Data?

The collection of My NASA Data lesson plans is intended to provide the educator with a variety of specific examples, incorporating a more "teacher-directed" strategy, of how authentic satellite data can be integrated into the curriculum.

Access the MND Data Visualization

my NASA data

Search

Atmosphere | Biosphere | Geosphere | Hydrosphere | Cryosphere | Earth as a System | Visualize Data | Resources | Overview

Atmosphere – Featured Lessons

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Aenean euismod bibendum laoreet. Proin gravida dolor sit amet lacus accumsan et viverra justo commodo. Proin sodales pulvinar tempor. Uber ad sociis natoque penatibus et magnis dis parturient montes, nascetur ridiculus mus. Nam fermentum, nulla luctus pharetra vulputate.

Featured Lessons | Maps & Data | STEM Career Connections | GLOBE Connections

DRAFT

Basic Line Plots

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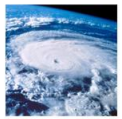
See All >

DRAFT

Recent Topics



Hurricanes: What Are They?
4/15/2018
Atmosphere, Teaching, K-6

How the Water Cycle Works
3/25/2018
Hydrosphere, Teaching, K-6

Clouds Affecting Temperature
3/22/2018
Atmosphere, Teaching, K-6

Lesson Plans

Learning Progressions (K2, 3-5, 6-8, 9-12)

Atmosphere Learning Progression
Grades 3-5: GLOBE Protocols Aligned with NASA Resources and NGSS Standards

NGSS Disciplinary Core Ideas Progression of Learning: Building on concepts developed in grades K-2 that focused on weather patterns, student
will examine the relationship associated with how patterns of typical weather conditions over different time scales can be used to describe clim
scientists use satellite data to analyze historical weather patterns to answer questions related to climate and typical weather patterns. By incor
and My NASA Data in the classroom educators provide students with the ability to collect data while connecting with NASA scientists and acces
to to answer their own questions related to atmospheric interactions that affect the weather and climate where they live.

Performance Expectations:
- **3-ESS2-1** Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season.
- **3-ESS2-2** Obtain and combine information to describe climates in different regions of the world.
- **5-ESS2-1** Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere and/or atmosphere interact.

Science Practices:
- **Analyzing and Interpreting Data:** Represent data in tables and various graphical displays (bar graphs and pictographs) to reveal patterns that indicate relationships.
- **Developing and Using Models:** Develop a model using an example to describe a scientific principle.
- **Obtaining, Evaluating and Communicating Information**: Obtain and combine information from books and other reliable media to explain phenomena.

Disciplinary Core Idea:
ESS2.D Weather and Climate: Scientists record patterns of the weather across different times and areas so that they can make predictions about what kind of weather might happen next.
ESS2.A Earth Materials and Systems:
Earth's major systems are the geosphere (solid and molten rock, soil, and sediments), the hydrosphere (water and ice), the atmosphere (air), and the biosphere (living things, including humans).

Crosscutting Concept
- **Patterns:** Pat
can be used t
predictions.
- **Systems and**
A system can
terms of its c
their interact

GLOBE Alignment: Environmental observations, data collection and learning activities to develop Earth science conce

Atmosphere Protocols:
- Air Temperature
- Clouds
- Surface Temperature
- Precipitation

Data Investigation Sheets:
- Atmosphere Investigation Integrated 1-Day
- Atmosphere Investigation Clouds 1-Day
- Atmosphere Investigation Surface Temperature

Elementary GLOBE Book:
- Do You Know That Clouds Have Names?
- What's Up in the Atmosphere? Exploring Colors in the Sky
- What in the World is Happening to Our Climate?

GLOBE Learning Activities: (Learning activities can be used to develop concepts associated with the NGSS Performance Expectations.)
1. Observing, Describing and Identifying Clouds (3-ESS2-1)
2. Estimating Cloud Cover (3-ESS2-1)
3. Cloud Watch (3-ESS2-1)
4. Cloudscape (3-ESS2-1)
5. Land, Water, and Air (5-ESS2-1)
6. Making a Climograph (3-ESS2-2)
7. C1: From Weather to Climate-Looking at Air Temperature Data (3-ESS2-1, 3-ESS2-2)
8. What Can We Learn About Our Seasons? (3-ESS2-1, 3-ESS2-2)
9. Sky Observers (3-ESS2-1)

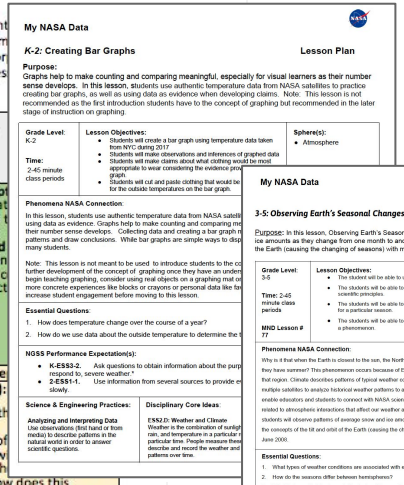
Guiding Question(s):
1. How is weath
seasons?
2. What type of
associated w
seasons in th
you live? How does this compare to climates in other regions around the world?
3. Describe the interactions of matter and energy occurring between the atmosphere and geosphere. Atmosphere and biosphere? Atmosphere and hydrosphere?

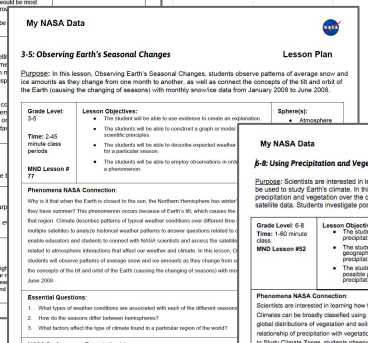
NASA Resource: Data and lessons drawn from NASA's Earth science research program

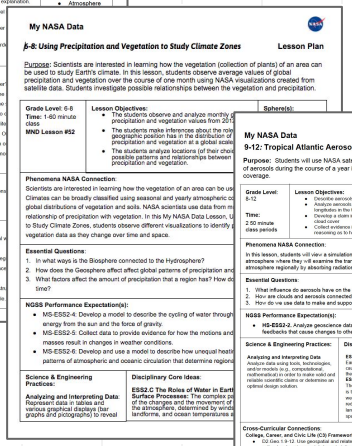
NASA Learning Activities:
- NASA Climate Change Educational Modules
- NASA's Climate Kids:
- NASA Wavelength 3-5 Learning Activities List

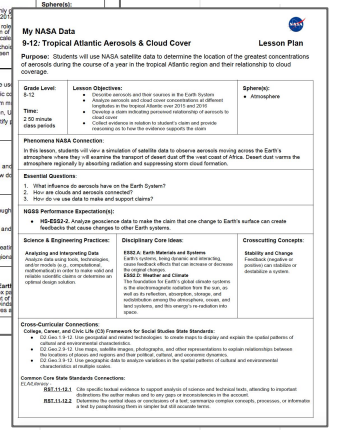
MY NASA DATA Live Access Server Data Visualization Tool.
Earth System Data Explorer:
My NASA Data Variable Suggestions:
Air Temperature: Monthly Near-Surface Air Temperature (ISCCP)
Clouds: Monthly Cloud Coverage (CERES TERRA)
Surface Temperature: Monthly Surface Skin Temperature (CERES)
Precipitation: Monthly Precipitation (GPCP)

NASA Lessons:
Climate Graphs (3-ESS2-1)
Cloudy vs Clear (3-ESS2-1)
Reading Bar Graphs (3-ESS2-1)


My NASA Data
K-2: Creating Bar Graphs
Lesson Plan
Purpose:
Graphs help to make counting and comparing meaningful, especially for visual learners as their number sense develops. In this lesson, students use authentic temperature data from NASA satellites to practice creating bar graphs, as well as using data as evidence when developing claims. Note: This lesson is not recommended as the first introduction students have to the concept of graphing but recommended in the later stage of instruction on graphing.

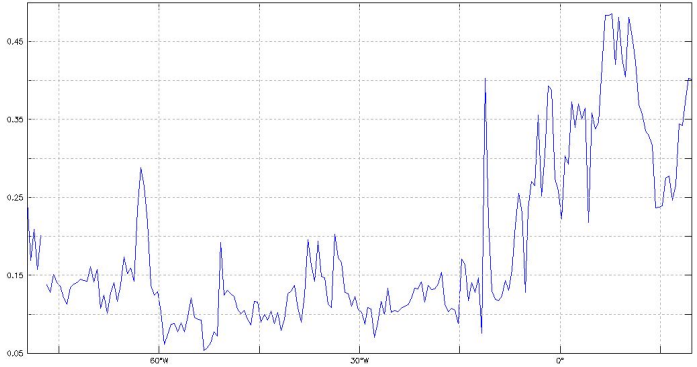

My NASA Data
3-5: Observing Earth's Seasonal Changes
Lesson Plan
Purpose: In this lesson, Observing Earth's Seasonal Changes, students observe patterns of average snow and ice amounts as they change from one month to another, as well as connect the concepts of the tilt and orbit of the Earth (causing the changing of seasons) with monthly snow/ice data from January 2008 to June 2008.

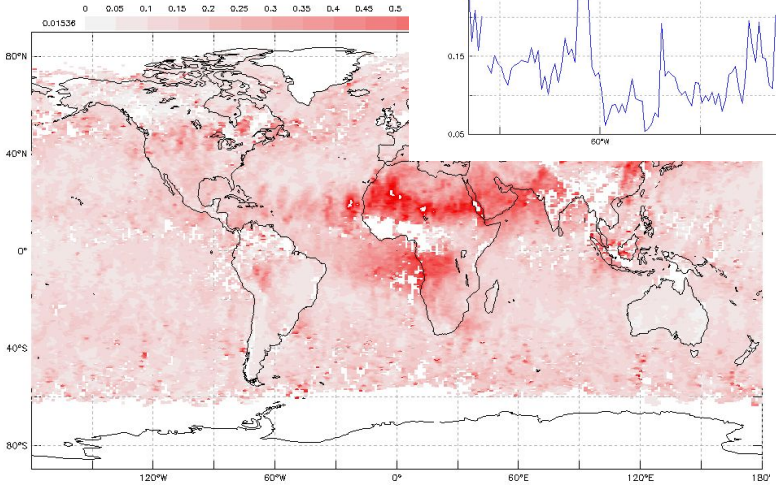

My NASA Data
6-8: Using Precipitation and Vegetation to Study Climate Zones
Lesson Plan
Purpose: Scientists are interested in learning how the vegetation (collection of plants) of an area can be used to study Earth's climate. In this lesson, students observe average values of global precipitation and vegetation over the course of one month using NASA visualizations created from satellite data. Students investigate possible relationships between the vegetation and precipitation.


My NASA Data
9-12: Tropical Atlantic Aerosols & Cloud Cover
Lesson Plan
Purpose: Students will use NASA satellite data to determine the location of the greatest concentrations of aerosols during the course of a year in the tropical Atlantic region and their relationship to cloud coverage.

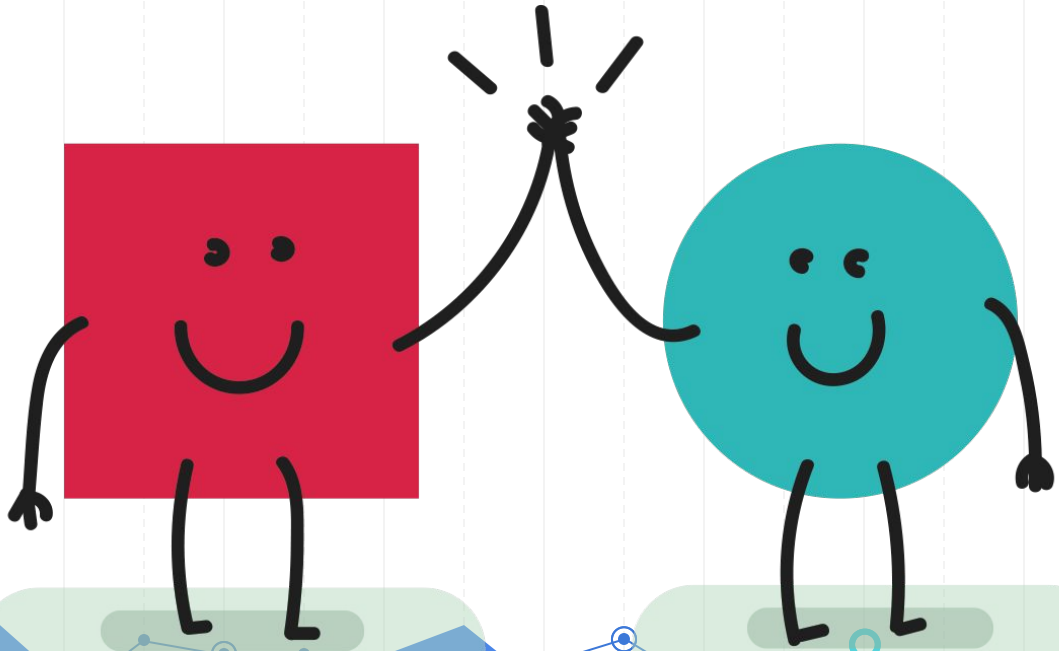
Preloaded & Organized by Sphere/Phenomenon

15-Jan-2016	37.4
15-Feb-2016	42.1
15-Mar-2016	58.7
15-Apr-2016	62.4
15-May-2016	67.8
15-Jun-2016	77.1
15-Jul-2016	81.0
15-Aug-2016	79.9
15-Sep-2016	75.1
15-Oct-2016	64.7
15-Nov-2016	53.8
15-Dec-2016	43.8
15-Jan-2017	45.0
15-Feb-2017	51.7



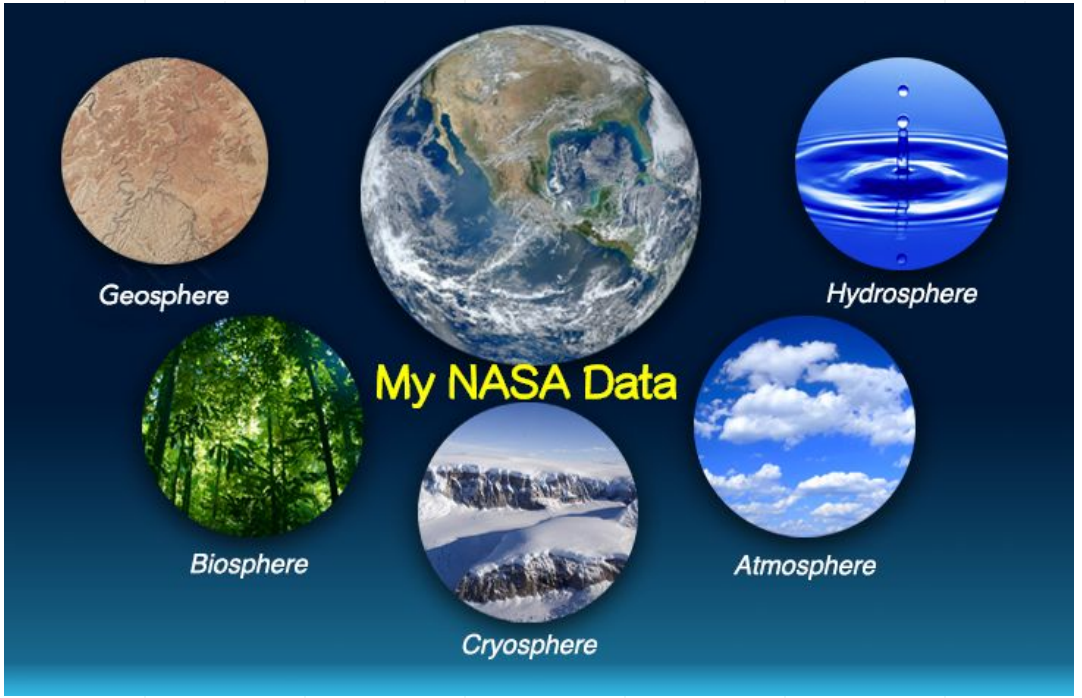


Group Work!



Seasons Phenomenon

1. **Identify the Earth Science variables affecting Seasons.** Put individual variables on a Post-It. (One Post-it per idea.)
   a. Put up at the front of the board in the different spheres of the Earth System
2. Share out.

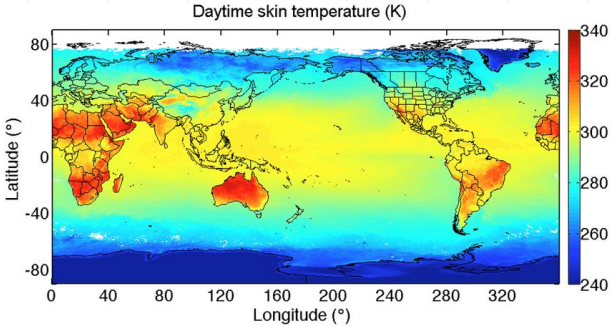


Earth System Variables Defined

Monthly Surface Skin Temperature is the temperature on the surface of the Earth (its "skin"), where humans, plants, and animals live. Monthly average of the temperature on the surface of the Earth (not the air temperature near the surface).

Beginner
Map

Intermediate
Graph

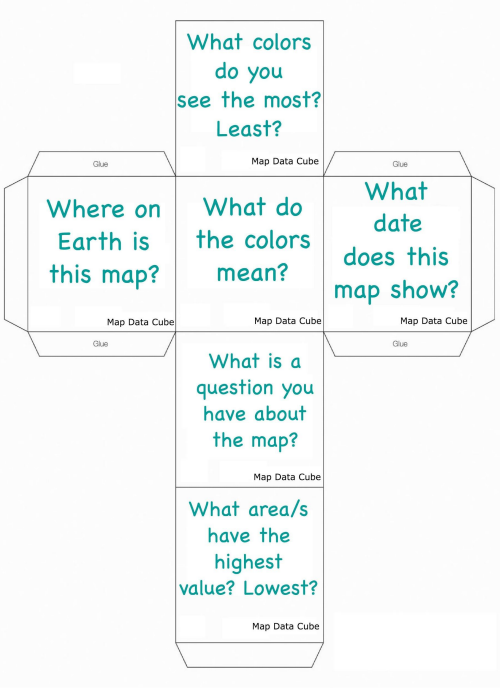


Leaf Area Index (**LAI**) is an unitless quantity that characterizes plant canopies.

LAI = leaf area / ground area, m^2 / m^2)

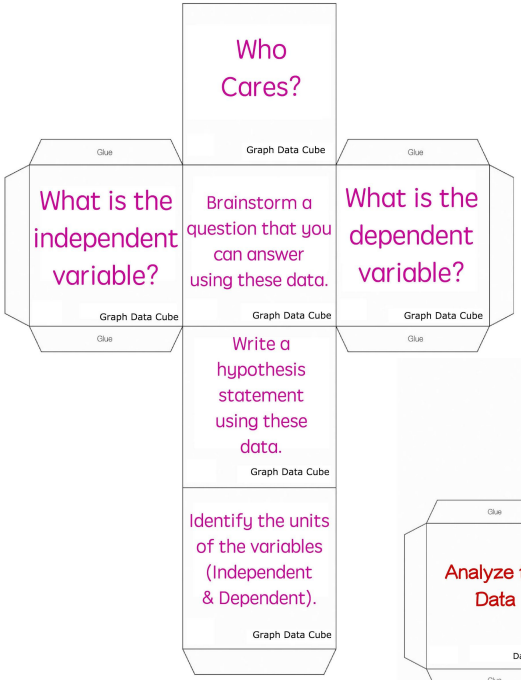
0 (bare ground) - over 10 (dense conifer forests).

Intermediate
Graph



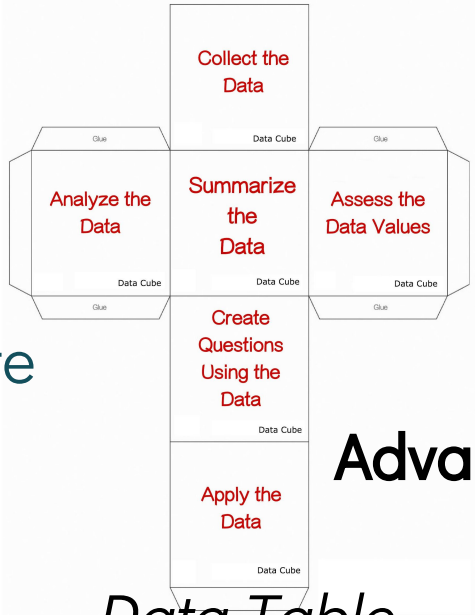
Beginner

Map

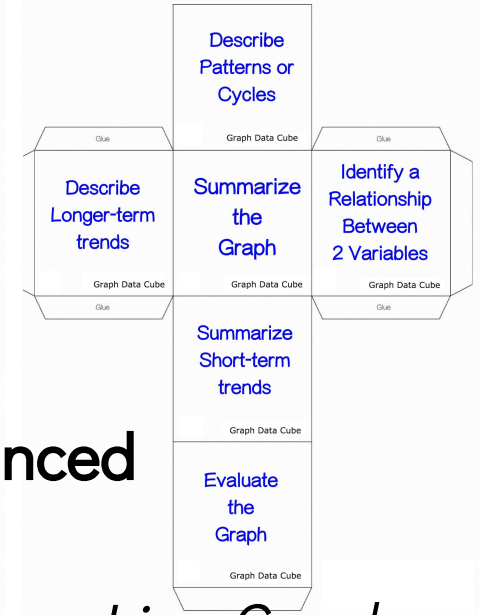


Intermediate

Graph



Data Table



Advanced

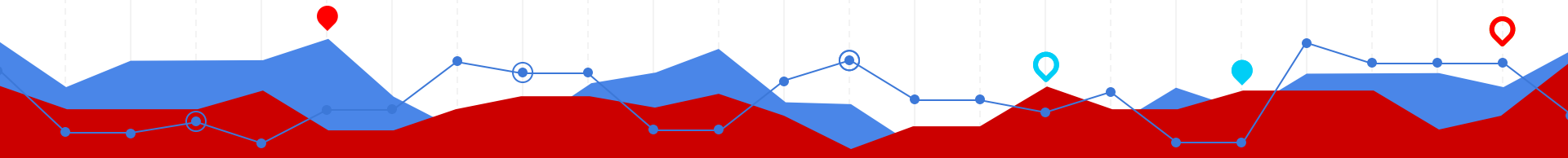
Line Graph

Data Literacy Activity

Beginner Activity - Analyze three mapped images of Surface Skin Temperature using the Beginner Map Cube

Intermediate Group - Analyze graphs (2010-2017) for the following datasets using the Intermediate Graph Cube:

- Average Surface Temperature
- Leaf Area Index



As you move through the activity, think of the following:

Setting students up for success:

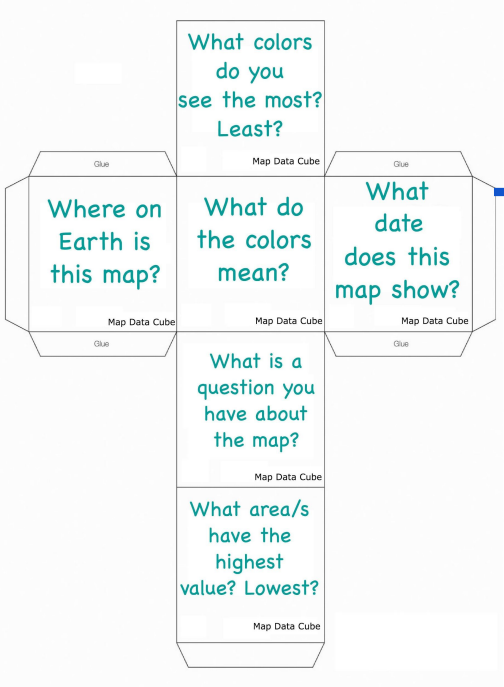
1. What modifications may you want to make?

2. What should students be doing? How will they demonstrate success?

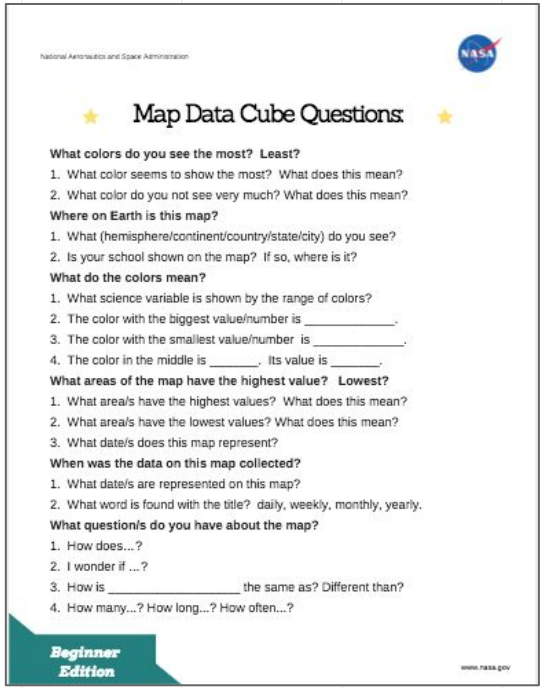
3. How do we measure success?

Beginner Cube:

Monthly Surface Skin Temperature (Celsius)



Beginner
Map



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Map Data Cube Questions:

What colors do you see the most? Least?
1. What color seems to show the most? What does this mean?
2. What color do you not see very much? What does this mean?

Where on Earth is this map?
1. What (hemisphere/continent/country/state/city) do you see?
2. Is your school shown on the map? If so, where is it?

What do the colors mean?
1. What science variable is shown by the range of colors?
2. The color with the biggest value/number is _____.
3. The color with the smallest value/number is _____.
4. The color in the middle is _____. Its value is _____.

What areas of the map have the highest value? Lowest?
1. What area/s have the highest values? What does this mean?
2. What area/s have the lowest values? What does this mean?
3. What date/s does this map represent?

When was the data on this map collected?
1. What date/s are represented on this map?
2. What word is found with the title? daily, weekly, monthly, yearly.

What question/s do you have about the map?
1. How does...?
2. I wonder if ...?
3. How is _____ the same as? Different than?
4. How many...? How long...? How often...?

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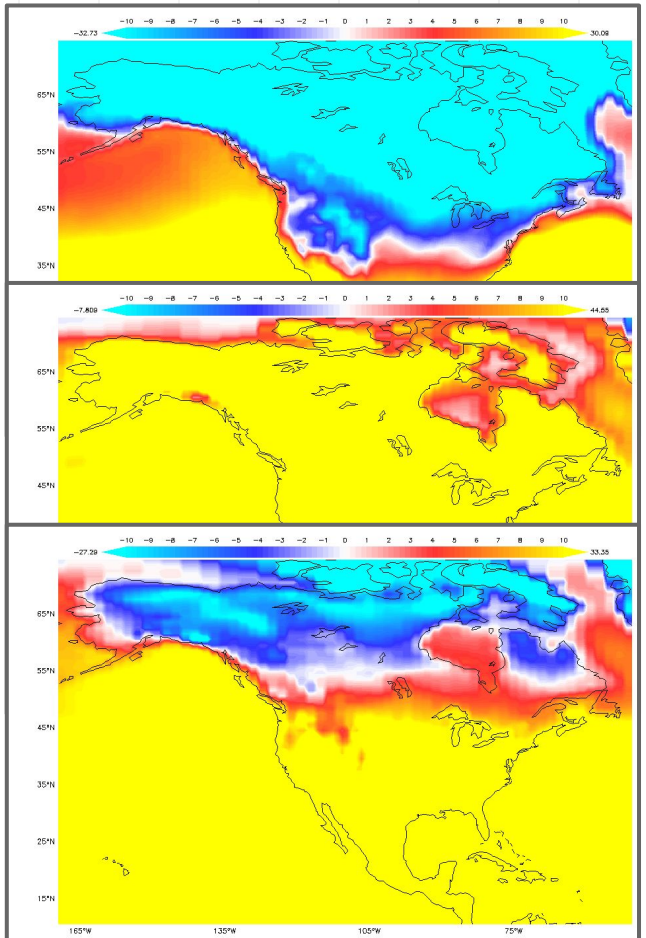
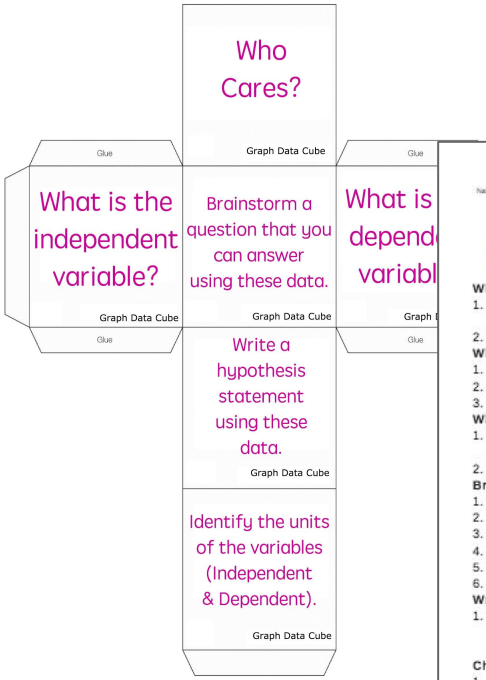


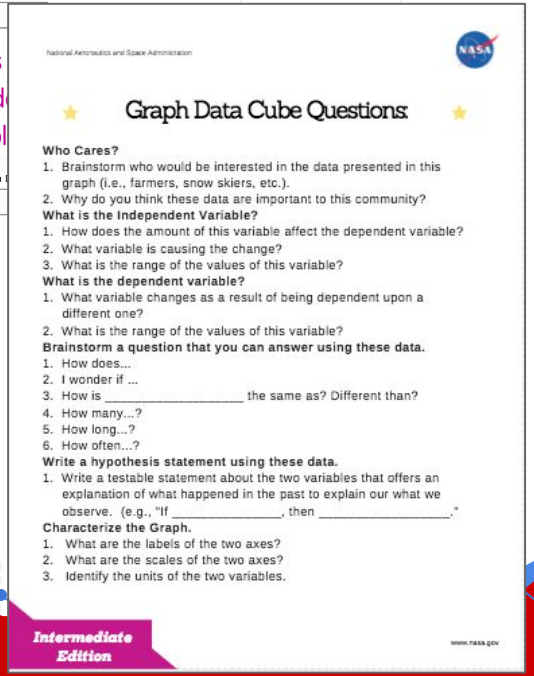
Intermediate Cube

Interpret two graphs:

1. Average Surface Temp (F) vs. Date (2010-2017) (Atlanta, GA Lat: 33.74N, Long: 84.38W)
2. Leaf Area Index vs. Date (2010-2017) (Atlanta, GA Lat: 33.74N, Long: 84.38W)



Intermediate *Graph*



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Graph Data Cube Questions

Who Cares?
1. Brainstorm who would be interested in the data presented in this graph (i.e., farmers, snow skiers, etc.).
2. Why do you think these data are important to this community?

What is the Independent Variable?
1. How does the amount of this variable affect the dependent variable?
2. What variable is causing the change?
3. What is the range of the values of this variable?

What is the dependent variable?
1. What variable changes as a result of being dependent upon a different one?
2. What is the range of the values of this variable?

Brainstorm a question that you can answer using these data.
1. How does...
2. I wonder if ...
3. How is _____ the same as? Different than?
4. How many...?
5. How long...?
6. How often...?

Write a hypothesis statement using these data.
1. Write a testable statement about the two variables that offers an explanation of what happened in the past to explain our what we observe. (e.g., "If _____, then _____."

Characterize the Graph.
1. What are the labels of the two axes?
2. What are the scales of the two axes?
3. Identify the units of the two variables.

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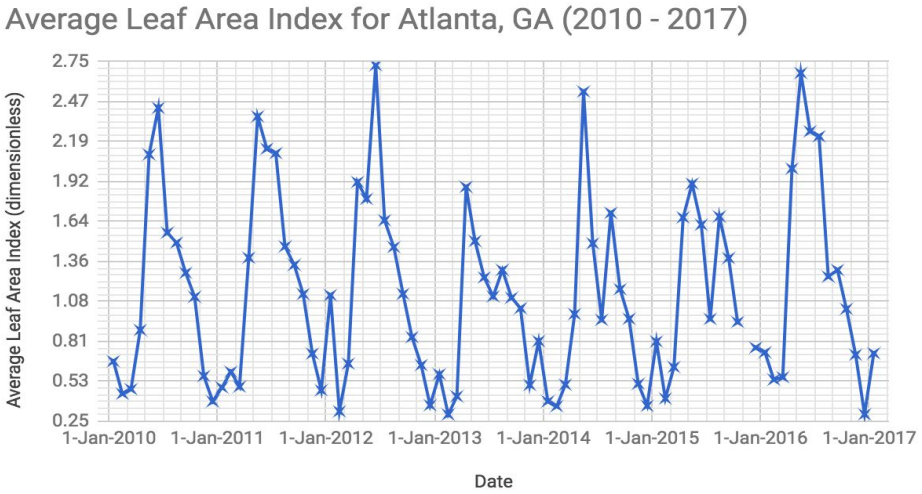
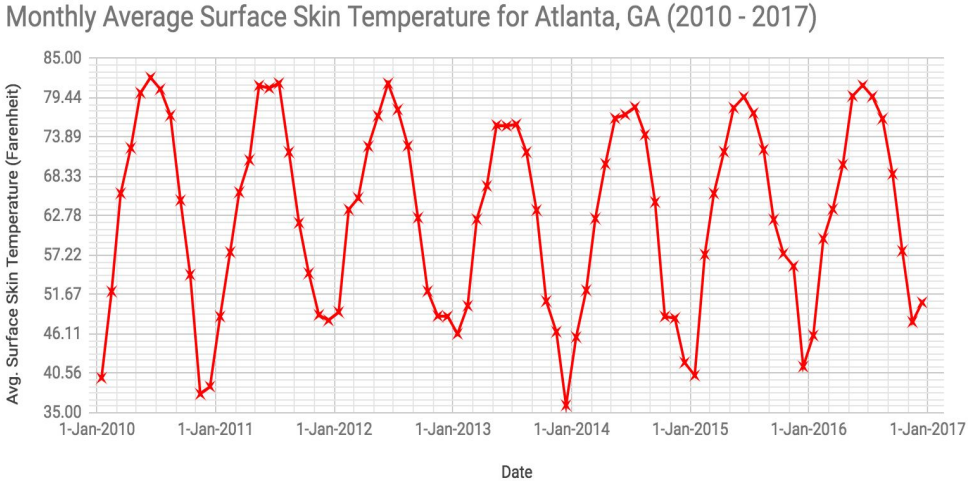
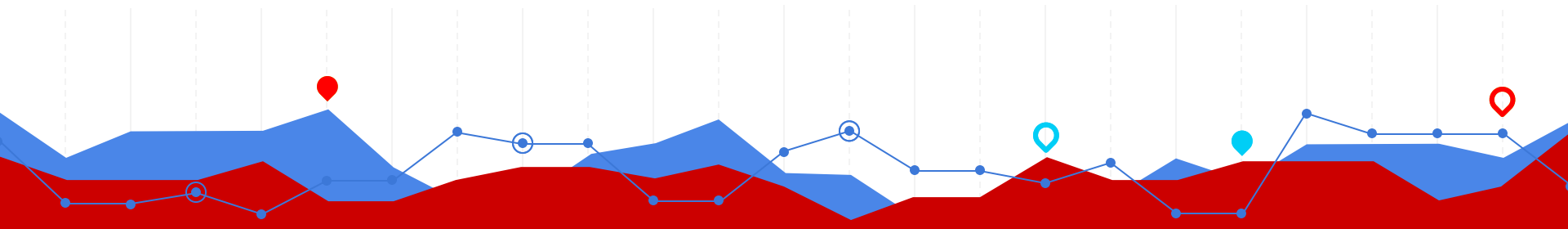
Interpret two graphs:



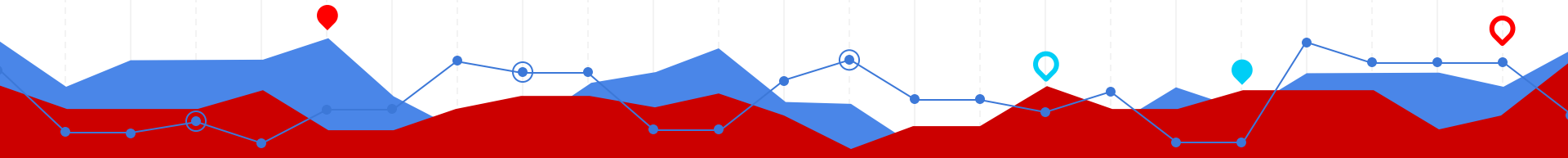




Share Out

Setting students up for success:

- What should students be doing?
- How do we measure success?
- What modifications may you want to make?



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http://bit.ly/2F3eqZB

Contact Me...

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